What is claimed is:

1. A voltage-controlled tunable filter including:

first and second cavity resonators;

means for exchanging a signal between the first and second cavity resonators;

a first voltage tunable dielectric capacitor positioned within the first cavity resonator;

means for applying a control voltage to the first voltage tunable dielectric capacitors;

a second voltage tunable dielectric capacitor positioned within the second cavity resonator;

means for applying a control voltage to the second voltage tunable dielectric capacitors;

an input coupled to the first cavity resonator; and

an output coupled to the first cavity resonator.

2. The voltage-controlled tunable filter of claim 1, wherein each of the first and second voltage tunable dielectric capacitors includes:

a first electrode;

a tunable dielectric film positioned on the first electrode; and

a second electrode positioned on a surface of the tunable dielectric film opposite the first electrode.

3. The voltage-controlled tunable filter of claim 2, wherein the tunable dielectric film comprises:

barium strontium titanate or a composite of barium strontium titanate.

4. The voltage-controlled tunable filter of claim 1, further comprising:

a plurality of additional coaxial resonators;

means for exchanging a signal between the additional resonators; and

a plurality of additional voltage tunable dielectric capacitors, each of the additional voltage tunable dielectric capacitors being positioned within one of the additional resonators.

5. The voltage-controlled tunable filter of claim 1, further comprising:

a first rod positioned in the first resonator, wherein the first voltage tunable dielectric capacitor is positioned at one end of the first rod; and

a second rod positioned in the second resonator, wherein the second voltage tunable dielectric capacitor is positioned at one end of the second rod.

6. The voltage-controlled tunable filter of claim 5, wherein:

each of the rods in the cavity resonators is serially connected with one of the voltage tunable dielectric capacitors.

7. The voltage-controlled tunable filter of claim 5, wherein:

each of the rods in the cavity resonators is grounded.

8. The voltage-controlled tunable filter of claim 1, wherein:

the input comprises a first coupling probe; and

the output comprises a second coupling probe.

9. The voltage-controlled tunable filter of claim 1, wherein each of the first and second voltage tunable dielectric capacitors includes:

a substrate;

a tunable dielectric film positioned on the substrate; and

first and second electrodes positioned on a surface of the tunable dielectric film opposite the substrate, the first and second electrodes being separated to form a gap.

10. The voltage-controlled tunable filter of claim 9, further comprising:

an insulating material for insulating the first and second electrodes and the tunable dielectric film from the first and second cavity resonators.